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## F01 Chassis and Suspension

**Subject** **Page**




Initial Print Date: 01/09 Revision Date:

# Chassis and Suspension

## Model: F01/F02

## Production: From Start of Production

# OBJECTIVES

After completion of this module you will be able to:

- Understand the differences between the Integral IV and V rear axle.
- Understand the differences between chassis components and systems on the F01 as compared to the E65.

# New Chassis Systems for F01/02

Through intelligent design layout and optimum package space utilization on the new F01/F02, the basis has been created for distinctly increasing the driving dynamics while improving comfort and vehicle handling.

At virtually identical wheel loads, a greater track width and a larger wheelbase have been realized compared to the predecessor, the E65.

The development of the new generation chassis and suspension systems in the new F01/F02 focused on revolution instead of evolution. The aim was to set a new benchmark.

The lightweight construction philosophy was consistently pursued in the design of the chassis and suspension systems. This is reflected in the widespread use of aluminum, representing an important contribution to increasing comfort and reducing CO2 emissions.

For the first time, a BMW Sedan is fitted with a double wishbone front axle made of aluminum, a steerable integral-V rear axle, BMW integral active steering (IAL) and the innovative damper system, the 2nd generation vertical dynamics control (VDC 2).

The integrated chassis management (ICM) intelligently links all chassis and suspension control systems, thus achieving a new level of functional quality. Further highlights include "Dynamic Drive" (ARS) and a fully variable power steering pump to improve fuel economy.

| Explanation | E65 | F01 | E66 | F02 |
|---|---|---|---|---|
| Overall length | 5039 mm | **5072 mm** | 5179 mm | **5212 mm** |
| Wheelbase | 2990 mm | **3070 mm** | 3130 mm | **3210 mm** |
| Overhang, front | 914 mm | 864 mm | 914 mm | 864 mm |
| Overhang, rear | 1135 mm | **1138 mm** | 1135 mm | **1138 mm** |
| Vehicle Width | 1902 mm | 1902 mm | 1902 mm | 1902 mm |
| Front track width (basic wheel) | 1578 mm | **1612 mm** | 1578 mm | **1612 mm** |
| Rear track width (basic wheel) | 1596 mm | **1646 mm** | 1596 mm | **1646 mm** |

## Chassis and Suspension Comparison

| Comparison | E65/E66 | F01/F02 |
|---|---|---|
| Front Axle | Doble pivot spring strut front axle | Double wishbone front axle |
| Suspension/damping, front | Steel spring/EDC | Steel spring/VDC 2 |
| Stabilizer bar, front | Passive or Active (ARS) | Passive or Active (ARS) |
| Rear axle | Integral IV | Integral V |
| Suspension/damping, rear | Steel spring or Air spring/EDC | Steel spring or Air spring (VDC2) |
| Stabilizer bar, rear | Passive or Active (ARS) | Passive or Active (ARS) |
| Brake, front | Disc brake with rotor diameter of 348mm | Disc brake with rotor diameter of 373mm |
| Brake, rear | Disc brake with rotor diameter of 345mm | Disc brake with rotor diameter of 368mm |
| Parking brake | Drum brake with EMF | Drum brake with EMF |
| Wheels/tires | Standard tires | Runflat tires (as standard) |
| Steering | Power steering (w /Servotronic) | Power steering with Servotronic (optional IAL) |

## Track Width

The size of the track width at the front and rear has a decisive influence on the cornering characteristics of the vehicle and its tendency to roll.

- The track width should be as large as possible, however, it cannot exceed a defined value in relationship to the width of the vehicle.
- The fully deflected (spring compressed) wheel turned at full lock on the front axle must not scrape or snag in the wheel arch cutout.
- A certain degree of clearance for fitting snow chains is required on the drive axle (irrespective of whether this is the front, rear or both axles).
- The wheels must not make contact with any chassis or body parts when the suspension springs fully compress and rebound.

## Wheelbase

The wheelbase -measured from the center of the front axle to the center of the rear axle has a decisive influence on the vehicle handling properties.

A large wheelbase compared to the length of the vehicle permits favorable accommodation of the vehicle occupants between the axles and reduces the influence of the vehicle load on the overall load distribution. Short body overhang at the front and rear reduces the pitching tendency.

A short wheelbase, on the other hand, provides favorable cornering characteristics, i.e. a smaller turning circle at the same steering lock angle.

The outstandingly balanced values on the E65 result in safe, superior and agile vehicle handling characteristics that represent the standard in the luxury class segment also for the future. These technical data are the prerequisite for achieving the top position in its class.  In terms of driving dynamics, the F01/ F02 will assume a leading position without forfeiting driving and rolling comfort compared to the competition (with comparable equipment).

# System Overview

## Front Axle

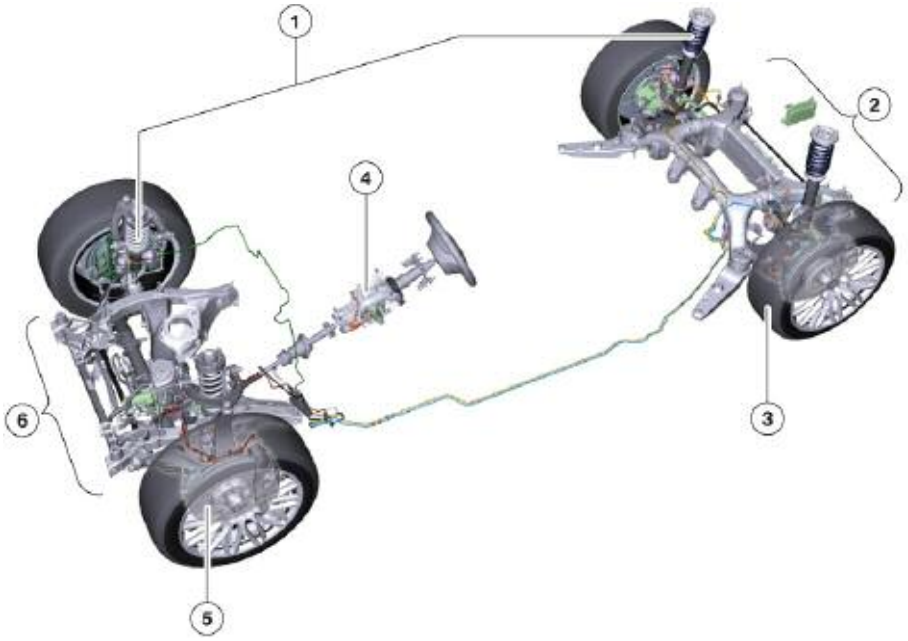
A double wishbone front axle as known from the E70 and E71 is now also fitted in the F01/ F02.

In comparison with the double pivot spring strut front axle on the E65, this front axle design offers the following advantages:

- Higher transverse acceleration is reflected in greater vehicle agility.
- Improved cornering/steering and transition characteristics which are particularly favourable in terms of rolling motion.
- Reduced interference means greater comfort.
- Shock absorbers that are subjected to virtually no transverse forces provide greater comfort.
- The design layout of the double wishbone front axle facilitates vertical dynamics control (VDC) and all-wheel drive (as on the E70/E71) without the need to adjust height and no spring travel loss.
- Double wishbone front axles improve directional stability.

The outstanding driving dynamics, the excellent driving comfort as well as the exceptional directional stability are factors of this double wishbone front axle design solution that contribute to a high degree of driving pleasure and safety while making the vehicle ideal for every day use and providing the most relaxing drive on long journeys.

**F01/F02 Chassis and Suspension components**



| Index | Explanation | Index | Explanation |
|---|---|---|---|
| 1 | Spring/damper | 4 | Steering |
| 2 | Rear axle | 5 | Brakes |
| 3 | Wheels/tires | 6 | Front axle |

## Rear Axle

Compared to the integral IV rear axle, the further-developed integral-V rear axle in the F01/F02 is characterized by further improved driving dynamics without compromising comfort and driving safety.

Furthermore, a “distributed” integral-V rear axle was required in order to realize HSR (rear axle slip angle control) that is a fundamental part of the integral active steering system.

### Dampers/suspension

In the F01/F02, the range of spring/damper units extends from the steel spring with standard vertical dynamics control (VDC) through to the electronically controlled dampers that can also be combined with the single axle air spring on the rear axle.

### Brakes

The brake system on the F01/F02 is a furtherdeveloped high performance brake system with newly adapted dimensions for the F01/ F02 and is dependent on the national market specification. The service brake is based on the conventional design, however, the parking brake features an electromechanical parking brake system (EMF).

### Steering

The F01/F02 is available with two steering system variants:

- Hydraulic servotronic
- Integral active steering (IAL).

Both steering systems are adapted to the varied application options of the F01/F02. The integral active steering is a new BMW development.

### Wheels and Tires

In contrast to its predecessor the E65/E66, the F01/F02 is now equipped as standard with a runflat safety package.

# System Components

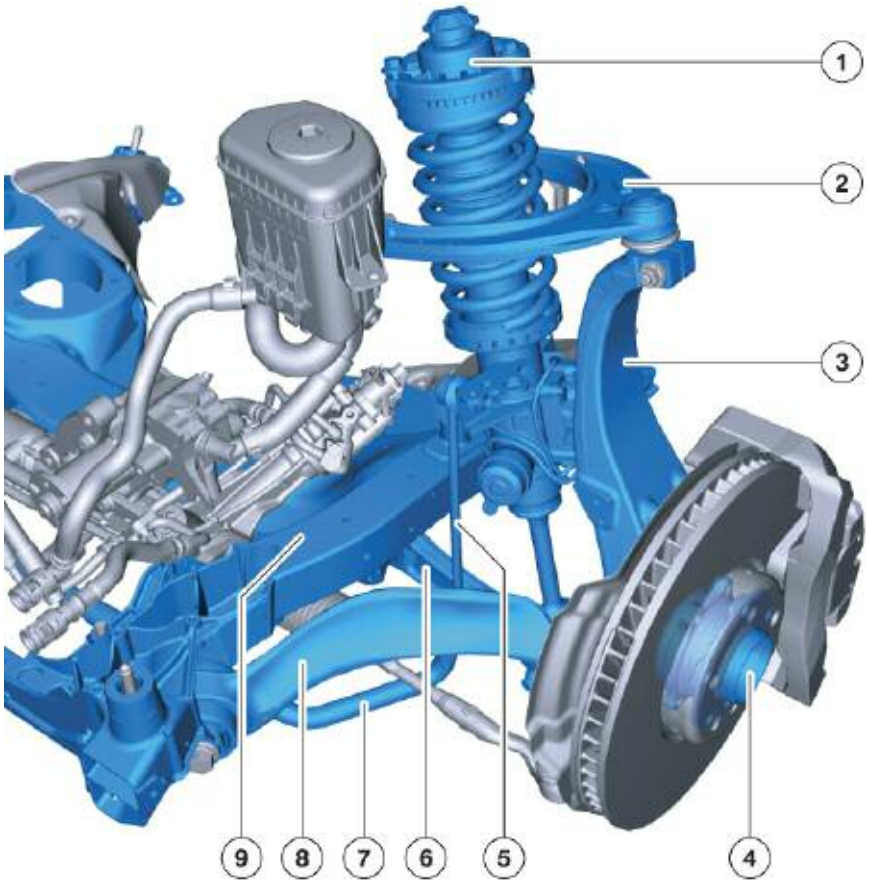
## General

The chassis and suspension is subdivided into the main components that are described in more detail in the following:

- Front axle
- Rear axle
- Damping/suspension
- Brakes
- Steering
- Wheels/tires.

## Front Axle

### Design Layout




**F01/F02 Front axle components**

| Index | Explanation | Index | Explanation |
|---|---|---|---|
| 1 | Spring strut | 6 | Transverse control arm, bottom |
| 2 | Transverse control arm, top | 7 | Stabilizer bar |
| 3 | Swivel bearing | 8 | Tension strut with hydraulic mount |
| 4 | Wheel bearing | 9 | Front suspension subframe |
| 5 | Stabilizer link | | |

The introduction of a second control arm level for wheel control, which is arranged above the wheel, results in additional degrees of freedom for the kinematics of the front axle as well as for the suspension/damping compared to other designs such as a spring strut front axle.

Components with special materials:

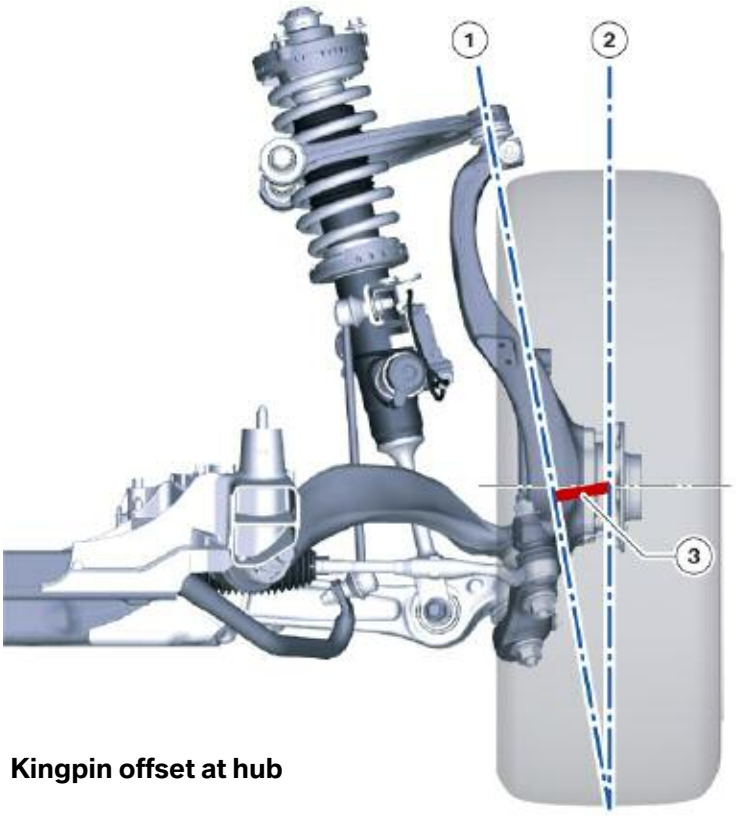
- The forged aluminum swivel bearing (3) with the 3rd generation wheel bearing (4).

**Note: The arms and links are bolted by means of ball/disc connections to the swivel bearing and, similar to the track rod heads, no longer have tapered screw fittings.**

- The transverse control arm at the top (2) is made from forged aluminum and the cylindrical joint pin is clamped in the swivel bearing (3).
- Tension strut with hydraulic mount (8) and lower transverse control arm (6) are forged aluminum components while the lower control arm bears the spring strut (1) by means of a forged steel mount.
- The new front axle subframe (9) is a welded aluminum structure which, as the standard axle, does not require the familiar aluminum thrust panel with service openings for increasing stiffness. This is made possible by the solid transverse section in the front axle subframe.

**Note: The design layout of the front axle subframe makes it possible to lower the complete steering gear for service purposes.**

**Virtual pivot point or steering pivot axis**




**Kingpin offset at hub**

| Index | Explanation | Index | Explanation |
|---|---|---|---|
| 1 | Steering pivot axis | 3 | Kingpin offset at hub |
| 2 | Wheel center plane | | |

The steering pivot axis of the wheel suspension is now formed by a joint at the top A-arm and the virtual pivot point of the lower arm level as known from the spring strut or McPherson front axle.

The steering pivot axis is therefore freely selectable and can be positioned such as to produce a small kingpin offset at hub with sufficient weight recoil.

This kingpin offset at hub is decisive for transmitting the irregularities on the road surface to the steering wheel. The lower and upper arm levels now move simultaneously in response to wheel deflection. As a result, as the spring compresses, the wheel pivots in such a way that the negative camber to the road does not decrease as much as is the case with a spring strut front axle.

Since the two control arm levels undertake the wheel control, the damper is virtually no longer subjected to transverse forces and rotational motion.

This makes it possible to do without a roller bearing assembly (conventional strut mount) on the spring strut support. Instead of this conventional roller bearing a damping and support unit is installed that takes up all three load paths. The load paths are the damper piston rod, the inner auxiliary spring and the bearing spring. This damping and support unit is still referred to as the "strut mount".

Due to the lack of transverse forces, the piston rod can be made thinner, resulting in a similar displacement volume in the push and pull direction of the damper. This serves to improve the design layout of the damper and is the prerequisite for the innovative damper control system - vertical dynamics control (VDC).

Due to the substantially lower friction at the circumference of the piston rod, the damper can respond more sensitively.

By connecting the stabilizer bar via the stabilizer link to the spring strut, the torsion in response to body roll motion is equivalent to the total wheel lift from the inside to the outside of the curve (in other suspension setups, the stabilizer bars are connected to a transverse control arm and therefore achieve only a fraction of the torsion angle). Despite being highly effective, this high degree of torsion allows for the stabilizer bar to be made relatively thin which has a favorable effect on driving comfort and dynamics as well as saving weight.

**Comparison of front axle technical data**

| Description (Front axle data) | E65/E66 | F01/F02 |
|---|---|---|
| **Kingpin offset at hub (mm)** | **88.1** | **56.3** |
| Track width (mm) | 1578 | 1611 |
| Camber | -0° 20' ±20' | -0° 12' ±15' |
| Camber difference | 0° ±30' | 0° ±30' |
| Total toe-in | 10' ±8' | 16' ± 6' |
| Turning circle (**m**/ft) | **11.92**/39.10 | **12.15**/39.86 |
| Kingpin offset (mm) | 0 | 0.5 |
| Toe angle difference (toe out on turns) | 1° 27' ±30' | 12° 20' |
| Caster angle | 7° 27' ± 30' | 7° 0' |

### Cast aluminium spring support (body side)

On the E70, a cast aluminum spring support was used for the first time on the front end of the X Series. This assembly is now also used on the F01/F02. It offers the following advantages:

- Reduced weight through intelligent lightweight construction
- Improved driving dynamics thanks to higher degree of stiffness
- Less components therefore reduced manufacturing expenditure.

The cast aluminum spring support takes up the forces from the chassis and suspension and directs them into the car body. Both the spring strut as well as the upper transverse control arm are secured to the cast spring support. The component must exhibit a high degree of stiffness for this purpose. This is achieved by optimum material distribution by ensuring material is only accumulated where necessary. The spring support therefore represents an important contribution to controlling driving characteristics as it takes up both static and dynamic wheel forces. Since, with the cast construction, it is possible to integrate many individual functions and components in one single component, compared to the conventional shell construction, this setup is distinctly more compact while making a significant contribution to reducing weight.

- The cast aluminum lightweight construction reduces the weight by approx. 50 % compared to the conventional sheet steel construction
- More useful package space compared to conventional sheet steel construction -80 mm shorter front end
- Function-compliant design with specific local stiffening points adding to lightweight construction
- Integration of various brackets for mounting units etc. in the cast aluminum spring support with add-on parts.

The cast aluminum spring support is connected to the neighboring steel components (e.g. engine support) by means of a rivet-adhesion structure. The structure is of lower weight while making it possible to reduce the number of parts (no additional sheet metal brackets). Nevertheless, the vehicle body is more stable and torsionally rigid while increasing local stiffness. This design arrangement has a positive effect on improved driving dynamics.

### Service

**Note: The camber can also not be adjusted on the double wishbone front axle. As for the E70/ E71, two replacement upper transverse control arms are available for the F01/F02 should the camber need to be changed (e.g. after an accident). These replacement upper transverse control arms enable positive (+5 mm) and negative (-5 mm) correction.**

**Front axle wheel alignment is required during service when:**

| Component/screw Connection is Replaced | | |
|---|---|---|
| Front axle subframe | YES | |
| Steering gear | YES | |
| Transverse control arm, bottom | YES | |
| Rubber mount for lower transverse control arm | YES | |
| Tension strut | | NO |
| Rubber mount for tension strut | | NO |
| Transverse control arm, top | | NO |
| Rubber mount for upper transverse control arm | | NO |
| Track rod | YES | |
| Swivel bearing | YES | |
| Wheel bearing | | NO |
| Spring strut | | NO |
| Coil spring | | NO |
| Mount | | NO |

| Screw Connections are Released | | |
|---|---|---|
| Front axle subframe to body (lowering) | | NO |
| Steering gear unit to front axle subframe | YES | |
| Lower transverse control arm to front axle subframe | YES | |
| Lower transverse control arm to swivel bearing | | NO |
| Tension strut to front axle subframe | | NO |
| Tension strut to swivel bearing | | NO |
| Upper transverse control arm to body | | NO |
| Upper transverse control arm to swivel bearing | | NO |
| Track rod to steering gear | | NO |
| Track rod head to track rod | YES | |
| Track rod head to swivel bearing | | NO |
| Spring strut to lower transverse control arm | | NO |
| Strut mount to body | | NO |
| Lower steering shaft to steering gear | | NO |
| Steering column to lower steering shaft | | NO |

# Rear Axle

## Highlight in F01/F02

The integral-V rear axle is a revolutionary further development of the integral IV rear axle now installed in many BMW models.

The integral IV rear axle fulfils the primary function of the running gear and wheel control in a unique way while making a significant contribution to driving dynamics characteristic of a BMW.

Safety functions are defined by the superior vehicle control characteristics. Effective decoupling of the road and drive train guarantees outstanding levels of acoustic and vibration comfort.

The further developed integral-V rear axle in the F01/F02 also provides these properties. In addition, the new rear axle has been specifically tuned to the new requirements of the F01/F02:

- Larger vehicle dimensions
- Greater total weight
- Greater drive output
- Higher drive torque
- Runflat tires.

In addition, the demanding objectives relating to driving dynamics and comfort have been correspondingly adapted while the new system integrates driving dynamics systems required for this purpose.

The integral-V rear axle primarily fulfils the driving dynamics functions of the mechanical chassis and suspension, i.e. define elastokinematic wheel control in all relevant driving situations.

The particularly innovative BMW development of the integral active steering (IAL), however, makes specific demands in terms of the **elastokinematics** of the integral-V rear axle: To a certain extent, the wheels on the rear axle must be able to execute steering movements.

### Kinematics and elastokinematics

The spatial arrangement of the pivot points or pivot axes of the arms and links is known as kinematics. This term applies to components that are assumed to be non-deformable.

Elastokinematics takes into account the flexibility at least of the rubber-metal mounts, often of the ball joints and rarely of the components.

Various arms define the horizontal plane of the rear axle wheel suspension at the axle carrier and the wheel carrier. These arms are mounted such that they can rotate about an approximately horizontal axis of rotation and therefore allow vertical movement of the wheel carrier.

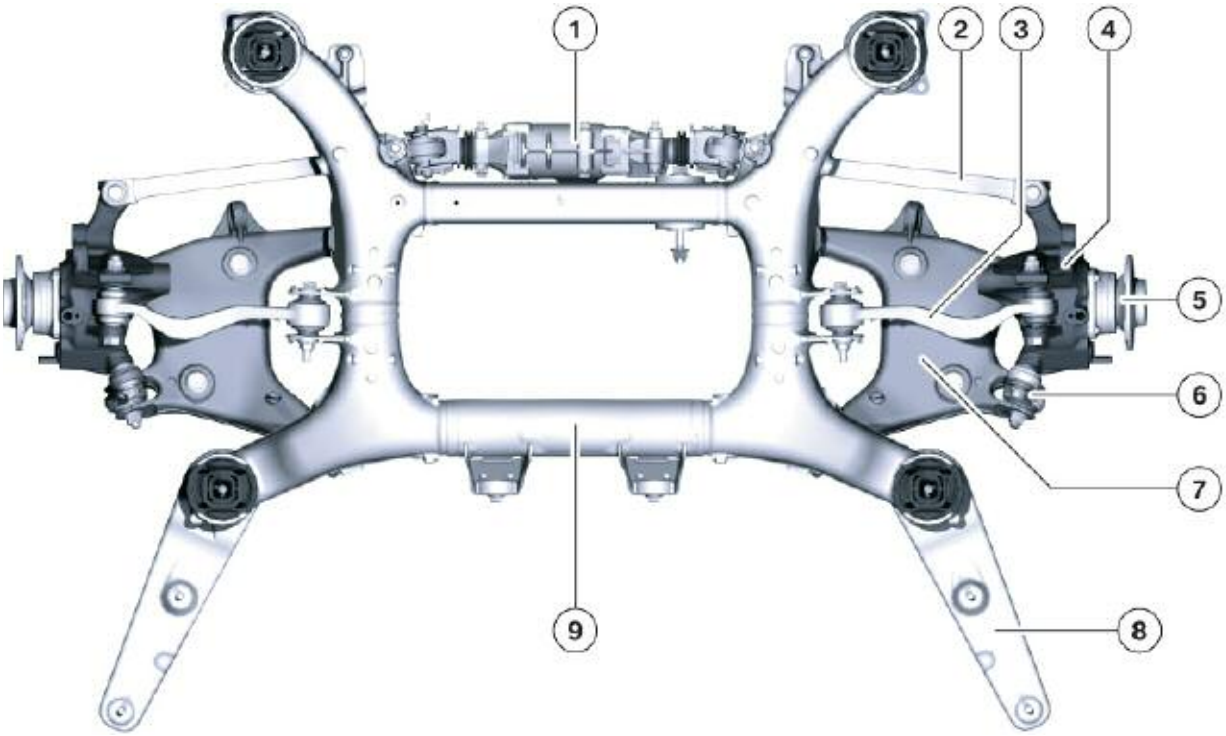
Kinematics is primarily of significance in terms of vehicle handling. The kinematics is arranged such that defined camber and toe-in angles are achieved between the wheel and road surface in response to the suspension and steering.

Kinematics is superimposed by elastokinematic effects. These elastokinematic effects occur as the movement points and movement axes are spatially displaced by the effect of the forces at the wheel.

### New challenge for the integral rear axle

In terms of the F01/F02, the new integral active steering (IAL) as a BMW driving dynamics innovation, posed a completely new challenge to the engineers and the tried and tested integral IV rear axle.The integral active steering is made up of the active steering and the rear axle slip angle control (HSR).

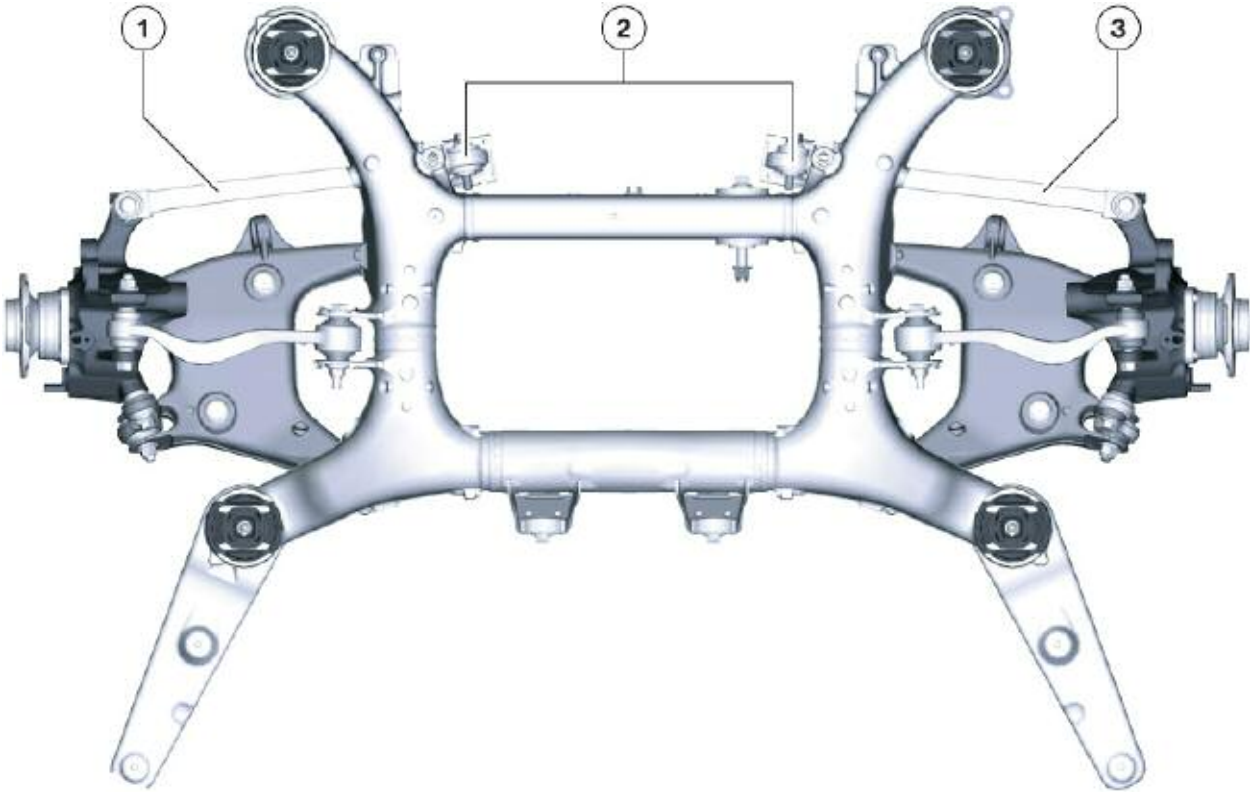
**Components of the integral V rear axle with integral active steering**




| Index | Explanation | Index | Explanation |
|---|---|---|---|
| 1 | Actuator, rear axle slip angle control (HSR) | 6 | Integral link |
| 2 | Track rod, left | 7 | A-arm (swinging arm) |
| 3 | Transverse control arm, top | 8 | Thrust strut |
| 4 | Wheel carrier | 9 | Rear axle carrier |
| 5 | Wheel bearing | | |

The principle of the integral-V rear axle makes it possible to resolve the conflict between driving dynamics and comfort. The dynamic and drive forces applied through the wheel contact point into the wheel suspension are taken up by the wheel carrier, rear axle carrier, three links and an A-arm (swinging arm).

**Integral V rear axle without integral active steering**




| Index | Explanation | Index | Explanation |
|---|---|---|---|
| 1 | Track rod, right | 3 | Track rod, left |
| 2 | Bearing assemblies, track rod | | |

The design layout reduces the flexible pulling action in the wheel carrier and therefore enables lengthways damping of the wheel control, which is important for rolling comfort, by means of axially soft front link mounts on the rear axle carrier.

Thanks to the position of the spring on the wheel carrier, it is no longer necessary to support the weight of the vehicle on the rubber mounts on the rear axle carrier.

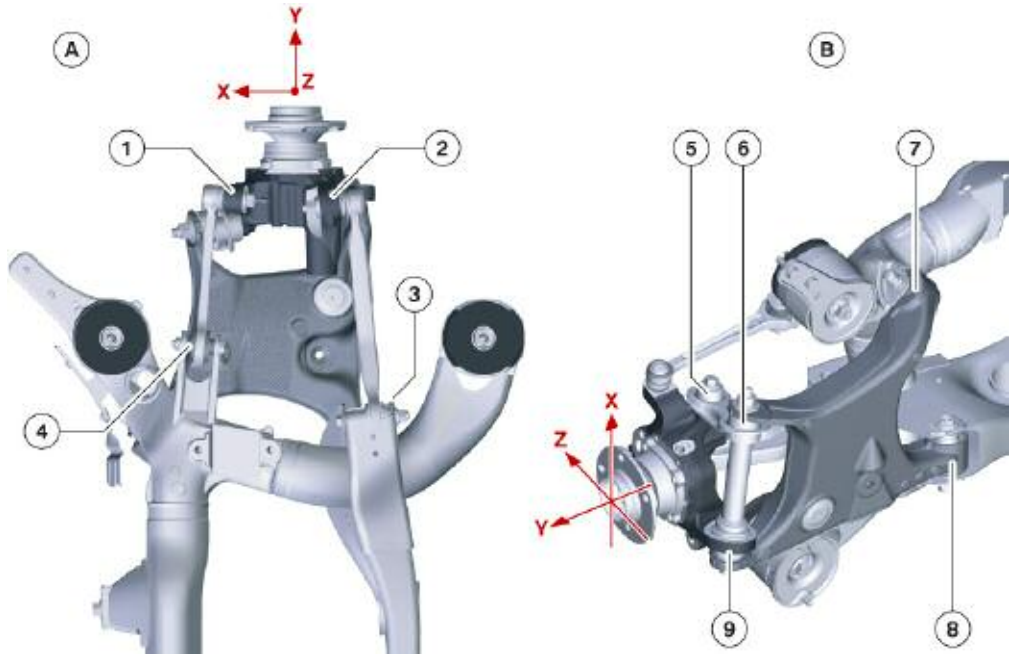
This optimum spring position in conjunction with specific lengthways control guarantees effective isolation of rolling and drive noise while significantly contributing to the refined smooth and quiet vehicle running characteristics.

The main criteria that governed the selection of materials included component weight, production process (cold forming, casting properties, welding properties), strength and deformation characteristics as well as corrosion resistance.

Two versions of the integral-V rear axle are available. Bearing assemblies are fitted on the two track rods if the vehicle is not equipped with integral active steering.

The revolutionary further development of the integral IV rear axle culminates in the BMW patented integral-V rear axle. The new arrangement of the arms and links as well as the use of ball joints facilitates a rear axle with steering capabilities.

### Arm arrangement, E65 integral IV rear axle



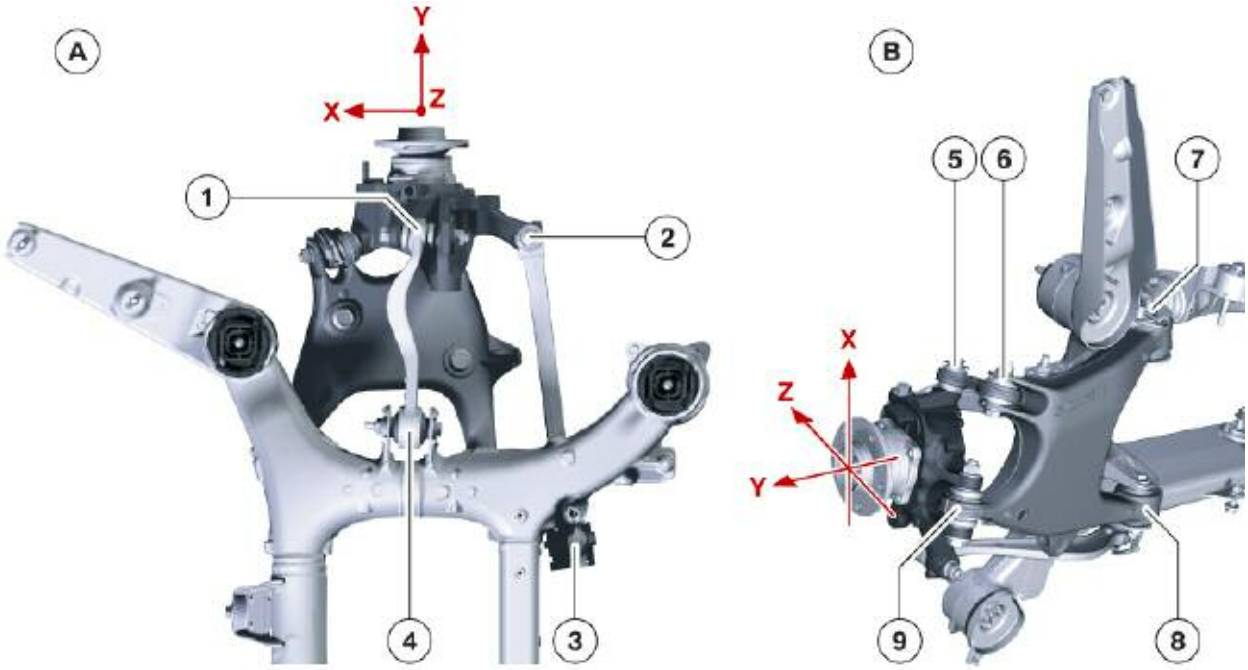

| Index | Explanation | Index | Explanation |
|---|---|---|---|
| A | Top view (forward direction x) | 5 | Rubber mount |
| B | Bottom side view | 6 | Rubber mount |
| 1 | Angle joint | 7 | Rubber mount |
| 2 | Angle joint | 8 | Rubber mount |
| 3 | Rubber mount | 9 | Ball joint |
| 4 | Rubber mount | | |

Viewing the arrangement of the arms and links in the integral IV rear axle of the E65 it is difficult to imaging that defined steering movement of the rear wheels about the Z-axis could be realized.

Theoretically, i.e. kinematically, the design of the integral IV rear axle could facilitate steering capabilities, however a large actuator would be required that could not be accommodated in the package space available on the F01/F02. This would have to be designed considerably longer and would therefore be decisively heavier and more expensive.

### Arm arrangement, integral-V rear axle in the F01/F02

Summary of the design layout:




| Index | Explanation | Index | Explanation |
|---|---|---|---|
| A | Top view (forward direction x) | 5 | Rubber mount |
| B | Bottom side view | 6 | Rubber mount |
| 1 | Ball joint | 7 | Rubber mount |
| 2 | Ball joint | 8 | Rubber mount |
| 3 | Rubber mount | 9 | Ball joint |
| 4 | Ball joint | | |

The system consists of a wheel carrier that is controlled from below by a torsionally rigid A-arm (swinging arm).

At the bottom, the wheel carrier is connected directly by means of a first bearing mount and indirectly by means of a second bearing mount, in connection with an integral link arranged vertically with respect to the plane of the A-arm (swinging arm), to the wheel carrier.

The two rubber mounts on the inside of the vehicle are connected to the rear axle carrier such that they are torsionally soft and can be displaced axially.

The upper transverse control arm lies approximately in the vertical plane of the drive shaft and therefore also at the center point of the wheel.

The rear track rod arranged approximately at the center point of the wheel is either mounted on the rear axle carrier or connected to the actuator of the integral active steering.

## Service

**Note: The track and camber at the rear axle can still be adjusted by means of two eccentric screws, however, a new procedure must be observed!**

| Description (Rear axle data) | F01 (Standard) | F01 (optional HSR) |
|---|---|---|
| Whee base (mm) | 3070 | 3070 |
| Track width | 1628 | **1650** |
| Camber | -1° 50' ±15’ | -1° 50' ±15’ |
| Camber difference | 0° ±30' | 0° ±30' |
| Total toe-in | 14' ±10’ | 16' ± 6' |
| Thrust angle | 0° ±12' | 0° ±12' |

## Damping/suspension

The standard chassis and suspension system of the F01 features steel springs on the front and rear axle. The standard chassis and suspension on the F02 has steel springs on the front axle with the single axle air suspension (EHC) fitted on the rear axle. The F01/F02 is equipped as standard with vertical dynamics control featuring electronically controlled damper systems. In addition, the following combinations are available:

- Standard suspension with single axle air spring
- Dynamic drive with steel springs and VDC dampers
- Dynamic drive with 2 steel springs and single axle air spring and VDC dampers.

BMW is the first car maker to offer as standard a continuously controlled adjusting damper system irrespective of tension/compression.

The outstanding properties of this new (VDC2) adjusting damper are:

- Advanced opening adjustment for improved body stabilization. Realized by adjustments even at low damper speeds.
- Difference between “soft” and “hard” in connection with driving dynamics control easily identifiable by the customer.
- Separately tuned identifier for rolling comfort through tension characteristics irrespective of compression.

## Brakes

Function-optimized lightweight construction brakes are used on the F01/F02.

Lightweight brake rotors with riveted aluminum hubs are installed on the front axle, while cast iron rotor are used on the rear axle.

Floating brake calipers are fitted on the front and rear axle. The brake system in the F01/F02 features the known brake wear monitoring system for the CBS indicator.

Technical data, front axle:

| Technical data, front brakes | Specification |
|---|---|
| Brake caliper, piston diameter (mm) | 60 |
| Brake disc, thickness (mm) | 36 |
| Brake disc diameter (mm) | 373 |
| Brake disc diameter (inches) | 14.7 |
| Brake disc construction | Aluminum (riveted) |
| Brake caliper construction | Aluminum |

Technical data, rear axle:

| Technical data, rear brakes | Specification |
|---|---|
| Brake caliper, piston diameter (mm) | 44 |
| Brake disc, thickness (mm) | 24 |
| Brake disc diameter (mm) | 368 |
| Brake disc diameter (inches) | 14.5 |
| Brake disc construction | Cast iron |
| Brake caliper construction | Cast iron |

### Brake caliper

Brake calipers with optimized function and efficiency are fitted on the F01/F02.
The frame structure of the floating caliper effectively uses the package space available in the wheel.

In connection with effective brake cooling, the brake system achieves a high degree of thermal efficiency. The aluminum housing of the floating caliper saves weight while ensuring maximum operating efficiency.

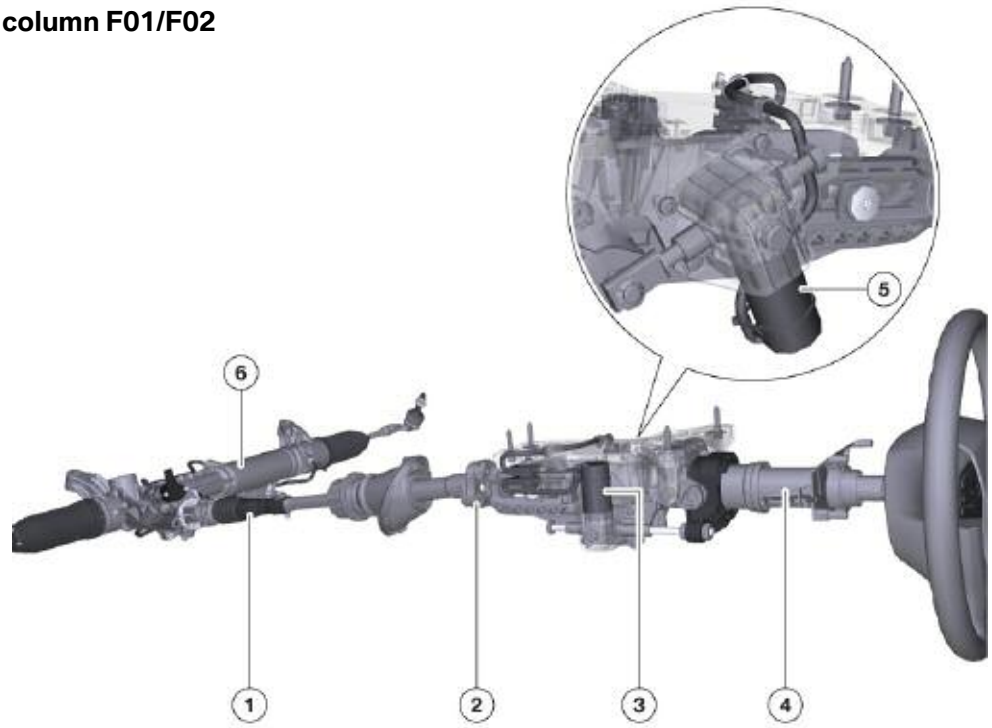
### Brake disc

The familiar riveted aluminum hub also saves weight while drastically reducing the shielding effect that may occur under harsh braking conditions, i.e. deformation of the brake disc caused by thermal material expansion. Internally ventilated brake discs are fitted on the front and rear axle.

## Steering

The steering column in the F01/F02 is ergonomics, comfort and passive occupant designed to conform with the most safety all coupled with characteristic BMW demanding requirements in terms of steering properties.

**Steering column F01/F02**




| Index | Explanation | Index | Explanation |
|---|---|---|---|
| 1 | Splined tube | 4 | Crash tube |
| 2 | Flexible coupling | 5 | Actuator motor, right |
| 3 | Actuator motor, left | 6 | Steering gear |

The F01/F02 is equipped with an electrically operated steering column with infinitely variable horizontal and vertical adjustment as standard.

- Outstanding ergonomics ensured by an optimum adjustment range for the steering wheel position:
  - Horizontal ± 30 mm
  - Vertical ± 20 mm
- Additional comfort function provided by easy entry and exit:
  - When getting in and out of the vehicle, the steering wheel temporarily moves into the topmost position thus providing maximum freedom of movement.
- Outstanding crash safety provided by the familiar, innovative BMW crash system, specifically tuned and featuring force-dependent energy absorbers.

The steering column has a motor for in/out adjustment and a motor for up/down adjustment with a specially developed gear mechanism.

Each of these low-noise drive units is mounted acoustically decoupled executes the adjustment with the aid of motor/driven flexible spindles.

The components of the steering column are optimized in terms of rigidity in the comfort-relevant frequency range to reduce vibration and avoid disturbing steering wheel vibration and have been developed in line with a magnesium and aluminium lightweight construction concept.

The flexible coupling fitted in the steering column represents the perfect means of finely tuning the steering characteristics and driving comfort. Vehicle-specific loop packages are vulcanized in elastomer in this flexible coupling, allowing extremely high torque to be transmitter reliably and precisely. The steering column is thus successfully decoupled from disturbing influences caused by excitation from the road surface (axial impact or radial torque peaks).

**Example: Crash sleeve on steering column**


| Index | Explanation | Index | Explanation |
|---|---|---|---|
| 1 | Normal position (travel range 0 mm) | 2 | Crash position (travel range 80 mm) |

The innovative crash system essentially consists of a crash adapter and crash tube. In the event of a crash, the impact energy is progressively reduced for the driver by the crash tube breaking open and deforming, thus providing the advantage of reduced stress on the occupants in the event of a crash (integral part of the 5-star philosophy at BMW).

In addition, the lower and center steering shaft collapses during the crash thus preventing penetration of the steering column into the passenger compartment. The system design also prevents the back displacement of all components in the engine compartment and possible damage to the bulkhead.

## Wheels and Tires

Unlike the E65 predecessor, the F01/F02 is fitted with the RunFlat System Component RSC package on board as standard.

Highlights of the safety tires:

The BMW Group has put together a safety package with the aim of avoiding such accidents as well as the risk involved with changing a tire at the side of the road, at night or in wet conditions, in tunnels or at road construction.

The BMW runflat safety system:

- Warns the driver in good time of imminent tire pressure loss so that countermeasures can be taken
- Allows the journey to be continued for a defined distance even in the event of complete loss of tire pressure
- Keeps the tire safely on the rim even in the event of sudden tire pressure loss at high speed.

The system consisting of the RSC tires, rims with EH2+ contour and the electronic tire pressure monitoring system (TPMS), renders a spare wheel or space-saver wheel, breakdown kit or vehicle jack unnecessary and this creates more storage space in the luggage compartment while also saving weight.

### Extended Hump rims (EH2+)

The specially shaped rim humps ensure that the RSC tire cannot detach from the rim even in the case of sudden tire pressure loss. This means substantially greater safety particularly when driving at high speed and on winding roads.

### TPMS

The Tire Pressure Monitoring Systemmonitors the tire pressure via wheel mounted pressure sensors.  A warning lamp informs the driver of any irregularities that occur due to the loss of tire pressure.

**Note: The TPMS system does not exempt the driver from regularly checking the tire pressure.**

After changing the tire pressure or after changing a tire, the TPMS systemmust be reinitialized in order to restore the target values with the correct tire pressure.

The entire safety package consists of three components:

- Runflat tires
- Extended hump rims (EH2+)
- Tire Pressure Monitoring System (TPMS)

### RSC tires with emergency running properties

With its reinforced side walls, additional strip inserts and heat-resistant rubber mixtures, even when completely depressurized, the “self-supporting tire” makes it possible to continue the journey for a limited distance at a maximum speed of 50 mph. This means each tire is also its own spare wheel.

The maximum range after complete tire pressure loss is:

- approximately 250 miles at low vehicle load
- approximately 150 miles at medium vehicle load
- approximately 50 miles at high vehicle load.

ABS, ASC and DSC remain fully operational even in the event of complete tire pressure loss.

When driving with a run flat tire with no pressure, the standard VDC automatically distributes the vehicle weight over the remaining wheels so as to relieve the load on the depressurized tire with the aim of achieving the highest possible range for continued operation.

### F01/F02 Wheel sizes

For the benefit of creating a sports appearance and to improve the overall design, compared to the E65/E66 the track width on the F01/F02 has been increased while the wheel arch overhang has been reduced to a minimum.

In addition, the entire range of wheels for the F01/F02 has been aligned flush by correspondingly matching the outer rim offset so that, with the exception of the different rim dimensions, there are no longer any differences between the tire sizes.

The following table lists the standard wheels on the F01/F02.

| Explanation | 750i | 750Li |
|---|---|---|
| Front tire | 245/50 R 18 Y 100 Y RSC | 245/50 R 18 Y 100 Y RSC |
| Rear tire | 245/50 R 18 Y 100 Y RSC | 245/50 R 18 Y 100 Y RSC |
| Front rim | 8J x 18 EH2+LM - IS30 | 8J x 18 EH2+LM - IS30 |
| Rear rim | 8J x 18 EH2+LM - IS30 | 8J x 18 EH2+LM - IS30 |